

A REVISION OF THE MILLIPED GENUS *DELOPHON*,
WITH THE PROPOSAL OF TWO NEW TRIBES IN THE
SUBFAMILY ABACIONINAE (CALLIPODIDA:
CASPIOPETALIDAE)

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Abstract.—The callipodid milliped genus *Delophon* is revised. Three species are recognized: *D. georgianum* Chamberlin, the type species, *D. serrulatum* Causey, and *D. holti*, n. sp., known only from Hamblen Co., Tennessee. *Delophon carolinum* Hoffman is relegated to the synonymy of the type species. The three species are entirely allopatric and range from the Blue Ridge Province of western North Carolina and the Cumberland Mountains of Tennessee to the Gulf Coastal Plain of Alabama. A disjunct population of *D. georgianum* also occurs in the Kings Mountain region of North Carolina, which is some 50 miles east of the Blue Ridge Front in the Piedmont Plateau. *Delophon georgianum* and *D. serrulatum* are anatomically very similar and appear to be sister species; *D. holti*, however, appears to represent another evolutionary line. Generically, *Delophon* is related to *Abacion* and *Tetracion*, the other genera of the subfamily Abacioninae, but gonopodal differences warrant segregation into a different tribe. Keys to the tribes and genera of the Abacioninae and species of *Delophon* are presented, along with gonopod illustrations and a range map.

The milliped order Callipodida is well represented in the epigeal fauna of the southeastern United States by species of the distinctive genus *Abacion*. These large, brown-black, crested diplopods are commonly encountered in a variety of native and urban habitats in all physiographic provinces. Occurring sympatrically with *Abacion* in Tennessee, Alabama, and the southern Blue Ridge Province is a second callipodid genus, *Delophon*, which is smaller in size but displays the same general body coloration. Adults of *Delophon* closely resemble juveniles of *Abacion*, but can be distinguished by the absence of legless segments posteriorly, the more translucent exoskeleton, and by the crest and gonopodal characters set forth in the ensuing key. Individuals of *Delophon* are also much stiffer and harder to unroll without breaking than the juveniles of *Abacion* with which they can be confused. The two genera also appear to differ ecologically, as I have always found *Delophon* in moist litter, often near streams, and never in the dry pine and urban environments that *Abacion* frequents. The third southeastern callipodid genus, *Tetracion*, is exclusively troglobitic.

Unlike many North American milliped genera, the history of *Delophon* is short and simple. It was erected by Chamberlin (1943) in his typical fashion, with only three sentences of diagnosis, for a species from Gainesville, Georgia, which he named *georgianum*. Chamberlin did, however, note the principal diagnostic feature, the enlargement of the coxal process of the male gonopod into a sheath around the "telopodite," thus allowing for future recognition of the genus. Hoffman (1950) proposed a second name, *D. carolinum*, for specimens found at Highlands, North Carolina, and Causey (1954) described an additional species, *D. serrulatum*, from the Mobile Bay region of Alabama. The only other treatment is the listing of Chamberlin and Hoffman (1958). Hoffman (1979) assigned *Abacion*, *Tetracion*, and *Delophon* to the subfamily Abacioninae in the family Caspiopetalidae and reported that *Delophon* consisted of three species ranging from North Carolina to Alabama.

The purpose of this paper is to describe the genus *Delophon*, update the nomenclature of the established species and summarize their distribution, and diagnose a new species from Hamblen Co., Tennessee. The occasion is also taken to propose two new tribal categories for the Abacioninae. I am grateful to Richard L. Hoffman for the privilege of describing the new species and for comments on an early draft of the manuscript, and to him and William A. Shear for loan of material in their collections. The holotype of *D. serrulatum* Causey was kindly loaned by Norman I. Platnick, American Museum of Natural History (AMNH), and that of *D. carolinum* Hoffman, by Ralph E. Crabill, Jr., United States National Museum (USNM). Access to the type of *D. georgianum*, in the Chamberlin collection (RVC), was also courtesy of Dr. Hoffman. I also thank Drs. Platnick, Herbert W. Levi, Museum of Comparative Zoology, Harvard University (MCZ), and Howard V. Weems, Jr., Florida State Collection of Arthropods (FSCA), for access to specimens in their care. Material in the North Carolina State Museum collection is indicated by the acronym NCSM. This study was supported in part by financial aid from the National Science Foundation, Grant. No. DEB-7702596.

KEY TO TRIBES AND GENERA OF ABACIONINAE

1. Pore crests small and narrow, subequal in size to primary crests, not distinctly enlarged anteriorly; male gonopods without flagella; coxal processes thin and translucent, subequal in length to and sheathing telopodite femora *Delophonini*, new tribe
 *Delophon* Chamberlin
- Pore crests considerably larger than primary crests, distinctly enlarged anteriorly; male gonopods with flagella; coxal processes rela-

tively thick and opaque, shorter than and subparallel to femora
 Abacionini, new tribe
 2

- 2. Dorsum with only four primary crests between pore crests on all segments; flagellum of male gonopods relatively short, not extending to distal elements of telopodite; troglobitic species with elongated legs and antennae, reduced pigmentation, and fewer ocelli
 *Tetracion* Hoffman
- Dorsum with four primary crests between pore crests through segment 11, six primary crests thereafter; flagellum of male gonopods relatively long, extending to level of distal elements of telopodite; large pigmented epigean species, with normal legs, antennae, and ocellaria *Abacion* Rafinesque

Abacionini, new tribe

Components.—*Abacion* Rafinesque, 1820; *Tetracion* Hoffman, 1956.

Diagnosis.—A tribe of moderate-large callipodids with the following characteristics: pore crests distinctly larger than primary crests, ozopores located in widened anterior portion of crests; male gonopods possessing flagella, coxal processes shorter than and subparallel to femora.

Range.—Eastern United States east of central Great Plains, from Illinois and eastern Nebraska south to central Texas and east to New York and peninsular Florida. Species occur in subterranean and epigean environments. *Abacion* occurs in a wide variety of surface habitats in the eastern United States and is one of the most common indigenous, urban diplopods.

Delophonini, new tribe

Component.—*Delophon* Chamberlin, 1943.

Diagnosis.—A tribe of small callipodids with the following characteristics: pore crests subequal in size to primary crests, only slightly widened anteriorly, ozopores located in latter portion of crests; male gonopods without flagella, coxal processes thin and translucent, subequal in length to and sheathing telopodite femora.

Range.—Southern United States, from Cumberland Mountains of central Tennessee and Blue Ridge Mountains of western North Carolina to Gulf Coast of Alabama. Species occur exclusively in epigean habitats.

Genus *Delophon* Chamberlin

Delophon Chamberlin, 1943:13. Causey, 1954:63. Chamberlin and Hoffman, 1958: 112.

Type species.—*Delophon georgianum* Chamberlin, 1943, by original designation.

Description.—A genus of small callipodids with the following characteristics: body composed of head and 47–51 segments at maturity. Head broadly rounded between ocellaria; suture visible only in epicranial region; frons and clypeus flattened, subtrapezoidal, narrowing towards labrum, width across genae less than that across epicranium; ocellaria variably subtriangular, with prominent Organ of Tomosvary on inner margin just above antennal socket; antennae relatively long and slender, composed of seven segments, 3 and 6 the longest, with four sensory cones apically.

Body segments cylindrical in cross section, slightly flattened dorsad; all segments with numerous longitudinal ridges or crests beginning on caudal half of collum, medial crests on collum slightly shorter than lateral crests; segments with 10 dorsal crests between pore crests through segment 11, 14 dorsal crests thereafter; all crests running entire length of metaterga, some (primary) more distinct than others (secondary). Ozopores beginning on segment 6, located anteriorly in a dorsolateral crest; pore crests slightly larger than primary crests, forming a narrow V with point caudad. Dorsal setal formula as follows (method of Hoffman and Lohmander [1964]):

Segment	Setal Series					
	med.	a	b	c	d	e lat.
1		A	A	A	A	A
2		A	A	A	A	A
3		A	A	A	A	A
4		A	A	A	A	A
5		A	P	P	A	P
6		P	P	P	P	P

Legs with 7 segments; coxae of legs 3–4 of males and 2–10 of females with prominent ventral pads; all legs with prominent, curved claw. Hypoproct tripartite, with 2 prominent setae on quadratic median lobe and 1 spinneret projecting from under distal edge of each lateral lobe. Paraprocts divided by oblique suture into smaller posterior and larger anterior sclerites.

Gonopods (terminology of Hoffman [1954, 1956]) proportionally large, clearly visible externally, femur projecting caudad from segment 7 and postfemur reflexed abruptly laterad or anteriolaterad; with a large, laminate tibiotarsus and shorter, narrower parasolenomerite; postfemoral process present or absent; solenomerite located between and variously shielded by tibiotarsus and parasolenomerite, apically blunt or acute; course of prostatic groove distinctly demarcated by black pigmentation; coxal process thin and translucent, greatly enlarged and expanded into broad sheath partially surrounding femur, subequal in length to femur; flagellum completely absent; coxae connected by prominent sclerotized sternum (Fig. 4).

Distribution.—Southern United States from the Blue Ridge Province of western North Carolina south to the Gulf Coastal Plain of Alabama and west to the Cumberland Mountains of Tennessee.

Species.—Three are known, but it seems possible that an additional species may be discovered in central Tennessee-Kentucky. Causey (1954) presented a key to the callipodid genera in the Gulf Coastal states and to the species of *Delophon* recognized at that time. The following couplets are based on more definitive characters and incorporate nomenclatorial changes made herein.

KEY TO SPECIES OF *DELOPHON* (BASED ON ADULT MALES)

- 1. Distal elements of gonopods forming angle of approximately 45° with femur; parasolenomerite parallel to and only slightly shorter than tibiotarsus; solenomerite short and blunt, concealed by parasolenomerite and tibiotarsus; coxal process (sheath) with distomedial edge jagged, slightly expanded laterad apically 2
- Distal elements of gonopods forming angle of about 90° with femur; parasolenomerite much shorter than and not parallel to tibiotarsus; solenomerite much larger than parasolenomerite, broad basally and spiniform apically, clearly visible between parasolenomerite and tibiotarsus; coxal process (sheath) with distomedial edge smooth, strongly expanded laterad behind tibiotarsus *holti*, n. sp.
- 2. Postfemoral process present *georgianum* Chamberlin
- Postfemoral process absent *serrulatum* Causey

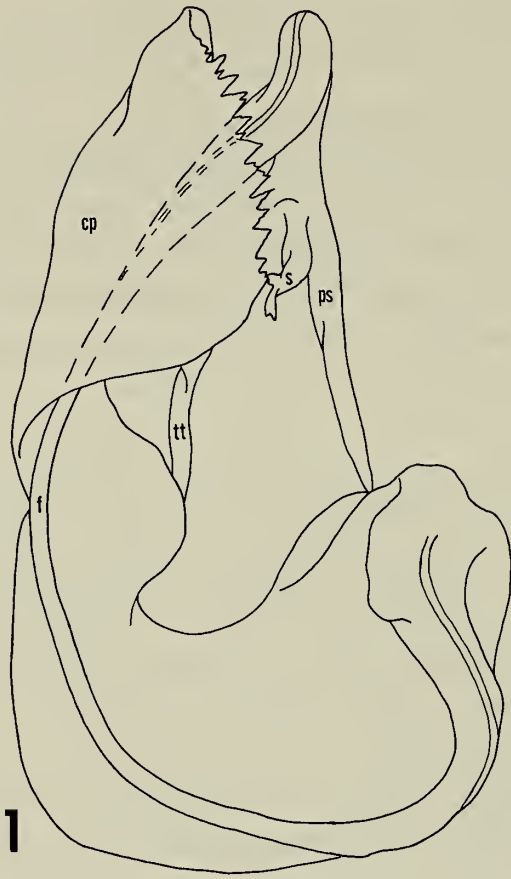
Delophon georgianum Chamberlin
Figs. 1–3

Delophon georgianum Chamberlin, 1943:13, figs. 28–30. Chamberlin and Hoffman, 1958:112.

Delophon carolinum Hoffman, 1950:18, pl. 5, fig. 4. Chamberlin and Hoffman, 1958:112. Wray, 1967:153. NEW SYNONYMY.

Type specimen.—Male holotype (RVC) collected by Wilton Ivie, 24 April 1943, from Gainesville, Hall Co., Georgia.

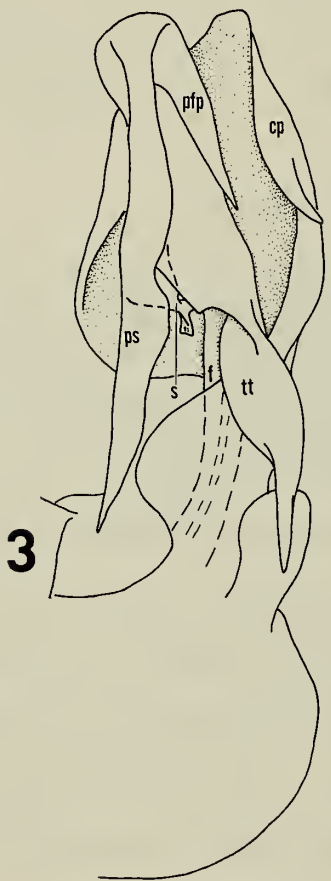
Diagnosis.—Distinguished by following features of male gonopods: elements distal to femur forming approximately 45° angle with femur; coxal process with distomedial edge jagged, distolateral margin entire, sheathing femur; postfemoral process present, spiniform, about 1/3 length of tibiotarsus, acuminate; tibiotarsus long and acuminate, cupped at midlength to accommodate solenomerite; solenomerite short, blunt, located between parasolenomerite and tibiotarsus.



1



2



3

Holotype.—The following details are supplemental to the original description by Chamberlin (1943).

Color of preserved specimen brown, fading laterally at poriferous carinae, epicranium and interantennal region dark mottled brown, fading out in clypeal region. Middorsal stripe absent from collum, beginning on protergum of segment 2.

Relative lengths of antennomeres as follows: $2 = 3 > 5 = 4 > 6 > 7 > 1$, 2–6 clavate.

Collum with about 20 crests of uniform height beginning near midlength, anterior half of collum smooth.

Gonopods (Figs. 1–3) with broadly curved femur projecting caudad from segment 7 to prozonite of segment 9; postfemur bent abruptly anterolaterad, expanding into broad tibiotarsus and parasolenomerite, extending to edge of segment 7; coxal process sheathing femoral region, extending caudad to level of apical femoral bend, distomedial margin jagged. Postfemoral process spiniform, approximately $\frac{1}{3}$ length of tibiotarsus, extending to just beyond level of separation of tibiotarsus and parasolenomerite and running parallel to latter processes, closely appressed to postfemoral surface. Tibiotarsus a large, acute, folded structure, cupped at midlength to partially sheath solenomerite. Parasolenomerite relatively straight, acute, slightly shorter than and parallel to tibiotarsus, expanded slightly at level of solenomerite; latter a short, blunt, bisinuately curved structure, flared apically with translucent subapical spur, located between parasolenomerite and tibiotarsus at approximately midlength of both these structures.

Variation.—The postfemoral process varies in length being extremely short on a male from Madison Co., NC (NCSM A359) and directed obliquely on a male from Wayah Bald, Macon Co., NC (RLH), so that it is almost perpendicular to the axis of the postfemur and tibiotarsus.

Ecology.—As noted in the introduction, this species is usually found in moist leaf litter, often near streams. Although common in the southern Blue Ridge Province, only a few individuals are usually found at one time. The largest samples I have seen contain only seven specimens.

Distribution.—With one notable exception, the range of *D. georgianum* coincides closely with the boundaries of the southern Blue Ridge Province. All the material from Tennessee has come from the eastern extremity of the state near the North Carolina border; none has been taken from the Ridge and Valley Province only a few miles to the west. The northernmost au-

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Figs. 1–3. *D. georgianum*, left gonopod of holotype. 1, medial view. 2, caudal view. 3, lateral view. Scale line = 0.5 mm. co, coxal process (sheath); f, femur; pfp, postfemoral process; ps, parasolenomerite; s, solenomerite; tt, tibiotarsus.

thentic record (with male specimens) is from the edge of the mountains in Wilkes Co., NC, and the southernmost is from the type locality, which is near the mountains but actually in the Piedmont Plateau of north Georgia. The most striking aspect of the distribution of *D. georgianum* is the occurrence of a disjunct population some 50 miles east of the Blue Ridge Front in the Kings Mountain region of North Carolina. This is a small area of mountains in the Piedmont Plateau containing peaks of over 1,000 ft. and is one of five inselberg areas in the state (Filka, 1978). No specimens have been collected in the intervening lowlands between the Kings Mountain region and the Blue Ridge Mountains, and the Kings Mountain population appears to be truly isolated from the remainder of the species. I can detect no anatomical differences, however, and find no reason to recognize this population taxonomically. This type of disjunct distribution in the southeast, in which isolated populations of predominantly montane species occur in the Piedmont, is obtained in a number of plant species, most notably the hemlock (*Tsuga canadensis*) and the white pine (*Pinus strobus*). Hardin and Cooper (1967) concluded that these plant disjuncts are relicts of a continuous Pleistocene forest which became dissected as climates warmed during post-glacial time. Perhaps the Kings Mountain population of *D. georgianum* is likewise a relict from a time when the species was more widely distributed and has since disappeared from most of its range due to climatic changes. Survival in the Kings Mountain region could have resulted from a slightly cooler microclimate afforded by the peaks and coves in this area.

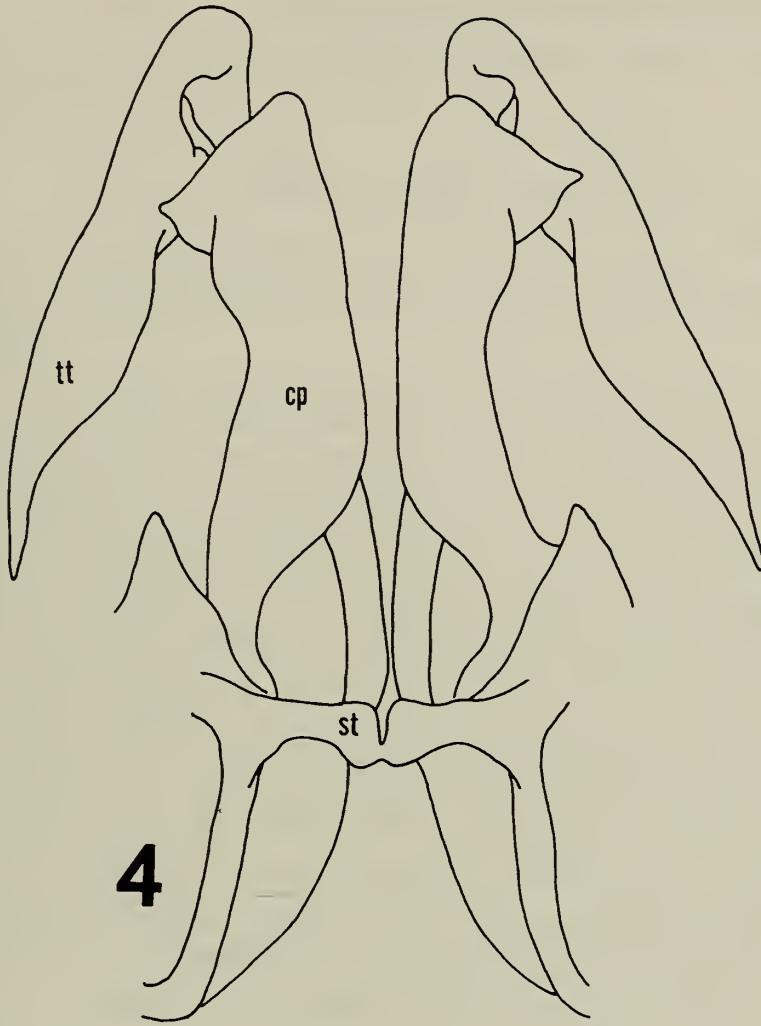
Specimens have been examined as follows:

Georgia: Habersham Co., Clarksville, M, F, 31 July 1958, R. L. Hoffman (RLH). Hall Co., Gainesville, M holotype, 24 April 1943, W. Ivie, (RVC) TYPE LOCALITY. White Co., along Tray Mtn. Rd. near McClure Cr., M, 24 June 1975, D. A. Rossman (AMNH). Rabun Co., N side Rabun Bald, near road to Rabun tower, M, F, 30 May 1964, H. R. Steeves (FSCA); and Glade Mtn., F, 27 July 1949, R. L. Hoffman (RLH).

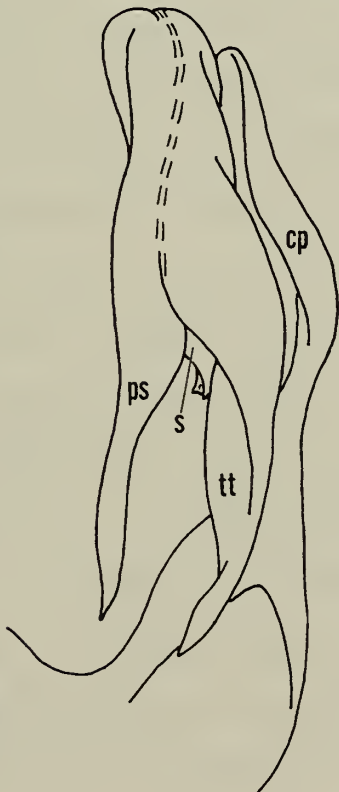
Tennessee: Monroe Co., 16 mi. SE Madisonville, campground on Citico Creek road, Cherokee National Forest, M, juv. F, 12 October 1978, R. M. Shelley and W. B. Jones (NCSM A2471). Sevier Co., Elkmont, Great Smoky Mountains National Park (GSMNP), 2 M, 2 F, 16–22 September 1959, W. Suter (FSCA); 10.1 mi. S Gatlinburg, 3,800' near small forest stream, GSMNP, 2 M, 24 May 1977, A. Newton, and M. Thayer (MCZ);

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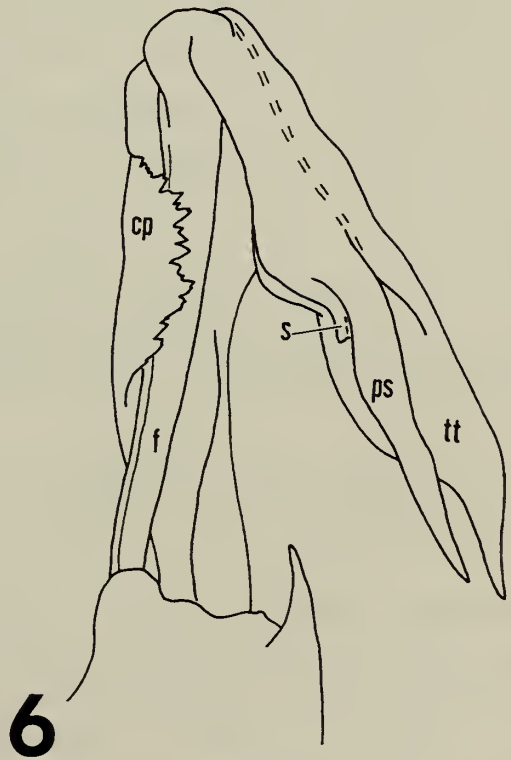
Figs. 4–6. *D. serrulatum*. 4, ventral view of gonopods of male specimen from Walker Co., GA, showing sternum (st). 5–6, left gonopod of specimen from Sequatchie Co., TN. 5, lateral view. 6, caudal view. Abbreviations as in Figs. 1–3. Scale line = 0.36 mm for Fig. 4, 0.43 mm for Figs. 5–6.



4



5



6

4.6 mi. S Gatlinburg 2,300', mixed hardwood forest, GSMNP, 2 F, 24 May 1977, A. Newton and M. Thayer (MCZ); Chimneys Picnic Area, 7.3 mi. S Gatlinburg, GSMNP, M, 16 May 1978, R. M. Shelley and W. B. Jones (NCSM A1892) and 5 F, 28 July 1949, R. L. Hoffman (RLH); Newfound Gap, 5,000' GSMNP, juv. M, 25 May 1962, L. Hubricht (RLH).

North Carolina: Macon Co., Coweeta Hydrological Station near Otto, 4 F, 1 August 1958, R. L. Hoffman (RLH), 2 M, 2 F, 27 September 1964, H. R. Steeves (FSCA), and M, 6 F, 23 May 1965, W. Suter (FSCA); Highlands, M, F, 21 July 1949, R. L. Hoffman (RLH); Buck Cr. clearcut, 1.6 mi. NW intersection Buck Cr. Rd. and co. rd. 1538, M, 2 July 1976, F. A. Coyle (NCSM A2129); and Wayah Bald, M, F, 3 July 1954, R. L. Hoffman (RLH). Jackson Co., Cullowhee Gap, M, 3 F, 10 July 1958, R. L. Hoffman (RLH); farm near Webster, M, 16 May 1970, W. A. Shear (WAS); and Cherokee Indian Reservation near Blue Ridge Parkway, F, 3 October 1960, W. J. Gertsch and W. Ivie (AMNH). Graham Co., Joyce Kilmer Memorial Forest, M, 3 F, 25 September 1971, F. A. Coyle (NCSM A2089); 4.8 mi. SSE Robbinsville, along co. rd. 1127, 0.2 mi. W jct. co. rd. 1116, F, 25 July 1974, R. M. Shelley (NCSM 2465); 2.8 mi. WSW Robbinsville, along co. rd. 1115, 2.5 mi. S jct. co. rd. 1120, M, F, 25 July 1975, R. M. Shelley (NCSM 2745). Swain Co., Deep Creek, 4 mi. N Bryson City, M, F, 1 October 1960, W. J. Gertsch and W. Ivie (AMNH); base Cliff Ridge near Nantahala, M, 6 May 1951, L. Hubricht (RLH); and Smokemont, GSMNP, F, 15 May 1978, R. M. Shelley and W. B. Jones (NCSM A1881). Haywood Co., GSMNP, Cataloochee Area, F, 8 July 1976, R. M. Shelley (NCSM A919). Transylvania Co., Thompson River Gorge SE Lake Toxaway, F, 5 September 1961, R. L. Hoffman (RLH); and Pink Beds Recreation Area, 8 mi. N Brevard, M, 5 F, 28 July 1958, R. L. Hoffman (RLH). Buncombe Co., N Bat Cave, 3 F, 5 July 1955, R. L. Hoffman (RLH). Madison Co., along US hwy. 25-70, 0.9 mi. N Hot Springs, M, 22 July 1975, R. M. Shelley and J. C. Clamp (NCSM A359); Paint Rock, M, 13 September 1952, L. Hubricht (RLH); and along US hwy. 70, 0.8 mi. NE jct. NC hwy. 22, F, 23 July 1971 (RLH). Mitchell Co., below Carver's Gap on Roan Mtn., 5,000', 2 F, 23 September 1950, L. Hubricht (RLH); and Altapass, M, 3 F, 20 May 1957, R. L. Hoffman (RLH). Wilkes Co., 7.2 mi. NW North Wilkesboro, along co. rd. 1541, 0.1 mi. E jct. co. rd. 1544, M, 12 August 1975, R. M. Shelley and J. C. Clamp (NCSM A466). Gaston Co., Crowders Mtn., M, 3 March 1950, D. L. Wray (FSCA); 4.8 mi. SW Gastonia, along co. rd. 1131, 0.2 mi. W. jct. co. rd. 1133, M, 29 April 1976, R. M. Shelley (NCSM A701); 4.4 mi. W Gastonia, along co. rd. 1122, 1.1 mi. E jct. co. rd. 1131, M, 10 July 1976, M. Filka and W. W. Thomson (NCSM A1123); 2.5 mi. S Bessemer City, along co. rd. 1125, 0.1 mi. S jct. US hwy. 74-29, M, F, 17 October 1976, M. Filka and G. Wicker (NCSM A2249) and M, 2 F, 9 April 1977, M. Filka (NCSM A2170); W of Gastonia on co. rd. 1106, 1.5 mi. E jct. co. rd. 1236, M, 16

October 1976, M. Filka and G. Wicker (NCSM A2312); and 7 mi. SE Bessemer City, along co. rd. 1103, jct. co. rd. 1112, M, 2 F, 9 April 1977, M. Filka (NCSM A2316).

Delophon serrulatum Causey

Figs. 4–6

Delophon serrulatum Causey, 1954:64, figs. 1–3. Chamberlin and Hoffman, 1958:112.

Type specimen.—Male holotype (AMNH) collected by N. B. Causey, 5 January 1954, from an unknown locality near Loxley, Baldwin Co., Alabama. The label in the vial states “Loxley, Baldwin Co., Mississippi,” but Causey (1954) reported that the locality was 9 miles west of Loxley at the junction of US hwy. 90 and Miss. state hwy. 89. Chamberlin and Hoffman (1958) corrected the state to Alabama but restated that the site was nine miles west of Loxley. The road map for Baldwin Co., however, does not show a state highway 89, and even if there were one, it would be east of Loxley rather than west, since the state highways numbered in the 80’s are all east of the town. In view of this confusion, it seems best to consider the type locality as being Loxley vicinity, Baldwin Co., Alabama.

Diagnosis.—Male gonopods similar in general appearance to those of *D. georgianum* except postfemoral process absent.

Holotype.—The following details are supplemental to the more complete description by Causey (1954).

Color of preserved specimen generally pale brown, fading laterally; epicranium a light mottled brown, interantennal region dark brown, fading out in clypeal region. Middorsal stripe absent from collum, beginning on protergum of segment 2, expanding slightly on segments 4–6, widest on segments 12–30, narrowing gradually thereafter to penultimate segment.

Relative lengths of antennomeres as follows: 2 = 3 > 5 > 4 > 6 > 7 > 1, 2–6 clavate.

Ocellaria roughly triangular, about 34 ocelli in irregular rows.

Anterior half of collum smooth, crests beginning near midlength.

Setae on collum located either on smooth portion or anterior portions of crests, none at posterior position.

Gonopods (Figs. 4–6) similar in size and configuration to those of *D. georgianum*, except postfemoral process entirely absent; subapical spur of solenomerite with edge deeply serrate.

Distribution.—*Delophon serrulatum* ranges from the southern Gulf Coastal Plain to the Cumberland Plateau of northern Alabama to the Ridge and Valley Province of Tennessee. It is completely allopatric with *D. georgianum*. Specimens have been examined as follows:

Alabama: Baldwin Co., Loxley vic., jct. AL hwy. 89 and US hwy. 90, M

holotype, 5 January 1954, N. B. Causey and D. Causey (AMNH) TYPE LOCALITY. Conecuh Co., 3 mi. W Brooklyn, outside Turk Cave, M, 11 August 1965, S. B. Peck (FSCA). Talladega Co., 6 mi. SW Sylacauga, M, 18 September 1959, W. Suter (FSCA). Shelby Co., Oak Mountain State Park, 2 M, 3 F, 16 October 1960, H. R. Steeves (FSCA), and 2 M, 3 F, 16 April 1965, N. B. Causey (FSCA). Marion Co., Hackleburg, 2 M, 5 F, 25 May 1964, J. W. King (FSCA). Winston Co., near Natural Bridge Cave, M, 8 June 1965, collector unknown (FSCA). Morgan Co., 3.5 mi. SE Fayetteville, M, F, 21 May 1972, S. B. Peck (WAS). Madison Co., Woodville, 2 M, 3 F, 7 September 1965, S. B. Peck (FSCA). Franklin Co., the Dismals, M, F, 17 June 1961, H. R. Steeves (FSCA), and M, 4 September 1961, W. Suter (FSCA). Jackson Co., Princeton, M, 29 October 1960, H. R. Steeves (FSCA); and 5 mi. NE Garth, 7 M, 6 F, 19 May 1972, S. B. Peck (WAS).

Georgia: Dade Co., Cloudland Canyon State Park, M, 15 April 1962, H. R. Steeves (FSCA), and M, F, 17 June 1962, H. R. Steeves (FSCA). Walker Co., 5 mi. SE Lafayette, M, 10 June 1967, S. B. Peck (WAS).

Tennessee: Marion Co., 2.2 mi. SE Monteagle, M, 9 May 1954, L. Hubricht (RLH). Sequatchie Co., 5 mi. SE Dunlap, wet woods in limestone ravine, M, 20 August 1956, R. L. Hoffman (RLH). Fentress Co., Jamestown, Jordan Motel, 3 M, 3 F, 16 June 1962, H. R. Steeves (FSCA).

Remarks.—The remarkable similarity in structure between *D. serrulatum* and *georgianum* suggests that they may be only geographic races of a single species. However, no specimens have been collected in the intervening area, and there is no alternative but to recognize two valid species until such material is obtained. My personal feeling is that the two forms are indeed reproductively isolated and that their present status is correct.

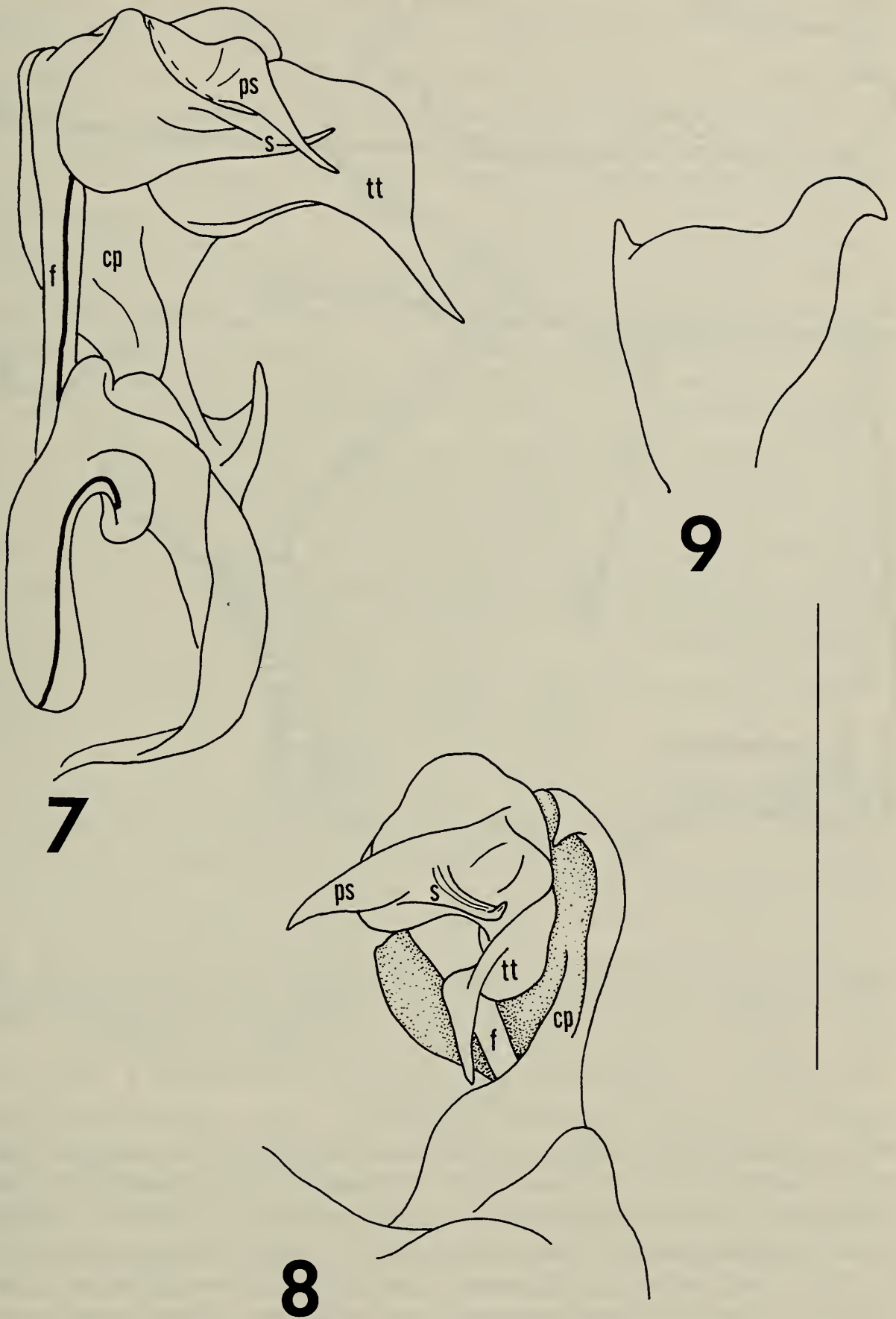
Delophon holti, new species¹

Figs. 7–9

Type specimens.—Male holotype and two male and one female paratypes (RLH) collected by R. L. Hoffman and P. C. Holt, 1 June 1952, from moist, wooded sinkholes ± 1 mi. SE Russellville, Hamblen Co., Tennessee. One male paratype deposited in NCSM collection.

Diagnosis.—Distinguished by following features of male gonopods: elements distal to femur forming approximately a right angle with femur; coxal process with distomedial edge smooth, sheathing femur and extending laterad about $\frac{1}{3}$ length of tibiotarsus; postfemoral process absent; parasolenomerite comparatively small, much shorter than and not parallel to tibi-

¹ This species was first recognized as new by Richard L. Hoffman, who generously allowed me to describe it, requesting only that it be named for Perry C. Holt, professor emeritus of biology at Virginia Polytechnic Institute and State University, Blacksburg, Virginia.



Figs. 7-9. *D. holti*, left gonopod of holotype. 7, caudal view. 8, lateral view. 9, distal portion of coxal process (sheath), ventral view. Abbreviations as in Figs. 1-3. Scale line = 0.5 mm.

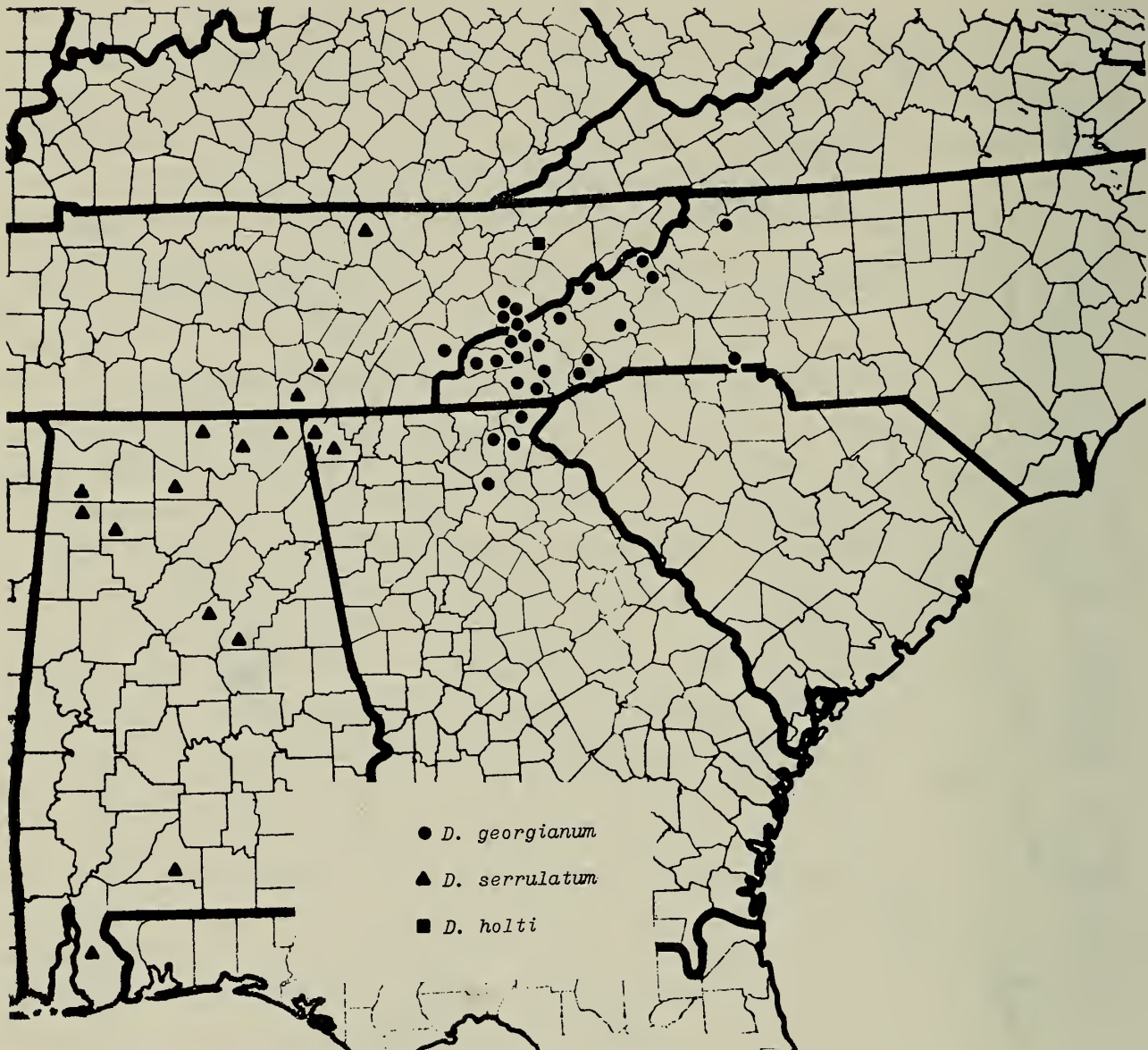


Fig. 10. Distribution of *Delophon*.

otarsus, arising from ventral surface of solenomerite; solenomerite large, broad basally and narrowing to acute, spiniform tip; tibiotarsus mostly broad, angling abruptly caudad apically into spiniform projection.

Description.—Length about 19 mm, greatest width about 1.1 mm; ca. 47 segments. Preserved specimens very pale in color, crests alone showing brown pigmentation; epicranium light mottled brown, interantennal region darker, fading out in clypeal region. Middorsal stripe absent from collum but present on remaining segments. Antennae long and slender, extending beyond caudal margin of segment 5; relative length of antennomeres $2 = 3 > 5 > 4 > 6 > 7 > 1$, 2–6 clavate. About 28 ocelli in subtriangular patch.

Collum with 17 crests beginning near midlength, medial crests shorter than lateral ones, anterior half of collum smooth. Secondary crests subequal to primary crests in height and length up to about segment 11, fading out

behind this segment; transition from 10–14 dorsal crests between pore crests on segment 12.

Gonopods (Figs. 7–9) small, femur extending caudad only to metazonite of segment 8; postfemur perpendicular to femur; tibiotarsus extending laterad to edge of body, distance between tibiotarsal apices subequal to width of body; coxal process very broad, sheathing femoral region, expanded laterad apically for about $\frac{1}{3}$ length of tibiotarsus, acuminate, edges not serrate. Postfemur very short, without postfemoral process. Tibiotarsus directed laterad, broadly curved and folded, concave at mid-length to accommodate solenomerite, angling abruptly caudad apically and narrowing into spiniform projection. Parasolenomerite relatively short, arising from ventral surface of solenomerite, broad basally but narrowing rapidly to acuminate tip, directed caudolaterad, not parallel to tibiotarsus. Solenomerite relatively large, broadly expanded basally but narrowing rapidly to acuminate tip, tip located between tibiotarsus and parasolenomerite, directed dorsolaterad.

Ecology.—In 1978 I visited the type locality in an unsuccessful attempt to find topotypes. This is a dry, rocky area that has largely been converted into pasture and is poor milliped habitat. The dominant trees are red cedars (*Juniperus virginiana*). The type specimens were found in a moist sinkhole, suggesting that *D. holti* may have specialized ecological requirements and occupy a particular niche which has been overlooked by field collectors.

Distribution.—Known only from the type locality.

Remarks.—As in *D. georgianum*, there are three terminal processes on the gonopods of *D. holti*, but this is because the solenomerite of the latter is large and spiniform. The solenomerite of the type species is a short blunt spur off the parasolenomerite and nearly concealed by the latter structure and the tibiotarsus. The postfemoral process of *D. georgianum*, one of the three terminal branches referred to by Causey (1954), is absent from *D. holti*. Thus, the three terminal branches of the gonopods of *D. holti* and *D. georgianum* are different and not an indication of any phylogenetic closeness between the two species.

Distribution

The distribution of each species of *Delophon* (Fig. 10) has been summarized in the appropriate account, and only one additional point needs to be emphasized. The three species are entirely allopatric, with no overlap in their known ranges. Additional collecting in the Cumberland Mountains and Plateau, which have not been intensively sampled, may reveal sympatry of *D. holti* and *serrulatum*, but I feel confident that only the type species occurs in the Blue Ridge Province. The thorough collecting in this area by myself and others would surely have produced another species by now if

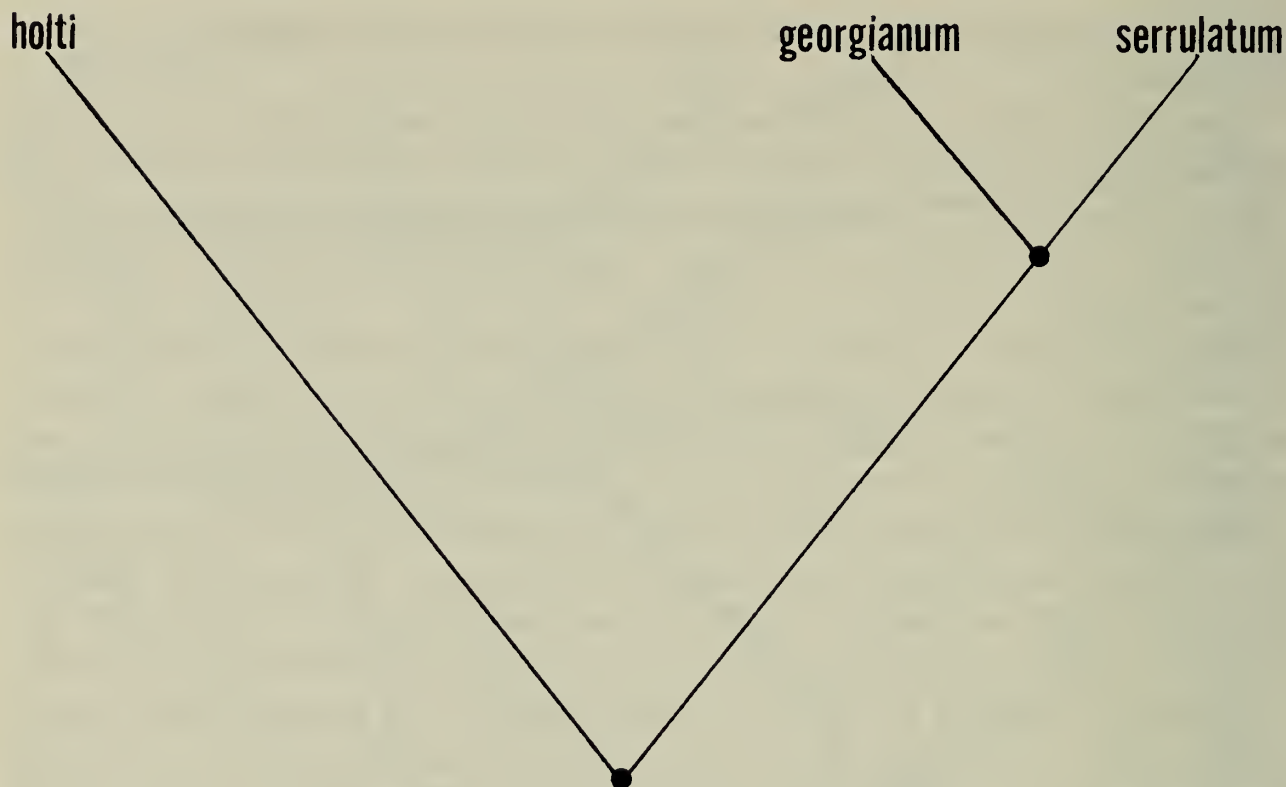


Fig. 11. Relationships in the genus *Delophon*.

one occurred there. Additional specimens of *D. holti* are needed to provide increased knowledge of its range, gonopodal variation, and the general biology of the species. It is possible, however, that the situation with *Delophon* may be analogous to that of the spirostreptid genus *Choctella*, in which there is one common, widely dispersed species, *C. cumminsi* Chamberlin, and one with a very restricted range, *C. hubrichti* Hoffman (Hoffman, 1965). It is worth noting in this regard that *D. holti* has only been collected once, some 27 years ago, a fact which suggests both a narrow range and reduced abundance.

Relationships

Generic: Relationships among North American callipodid genera are unclear. This topic was not discussed in the most definitive account (Loomis, 1937), at which time *Delophon* was unknown. Hoffman (1954) provided the foundation for such a consideration in his proposed terminology of callipodid gonopods, and he later (1956) mentioned that the male genitalia of *Tetracion* indicated affinity with both *Abacion* and *Delophon*. It seems clear that the affinities of *Delophon* are with the other two eastern genera and not with *Colactis*, *Heptium*, and the other western callipodids, which seem to represent a separate evolutionary line. The eastern genera all have a well developed tibiotarsal blade which projects laterad at a distinct angle from the femur, as opposed to being an expansion along the axis of the femur.

In *Tetracion* and *D. georgianum* and *serrulatum*, the angle between the femur and tibiotarsus is approximately 45°, whereas in *Abacion* and *D. holti*, it is about 90°. *Delophon* is unique, however, in the development of the coxal process into a large, translucent sheath around the femur and in the absence of the flagellum, which has been variously called a coxal process (Hoffman, 1954), sternal process (STP) (Hoffman, 1956), and coxosternal process (Shear, 1974).

Specific: The many gonopodal similarities—most notably a roughly 45° angle between the distal elements and the femora; the short, blunt solenomerites; and the long, blade-like parasolenomerites and tibiotarsi—point to a close affinity between *D. georgianum* and *serrulatum*. Their only difference involves the postfemoral process (present in *D. georgianum*, absent in *D. serrulatum*), and they seem to be sister species, only one step removed from a common ancestor. *Delophon holti*, however, is so entirely different from its congeners that it must represent a second line from some earlier source. That *D. holti* exists suggests the possibility of at least one additional undiscovered species of *Delophon*, its sister species, perhaps in central Tennessee-Kentucky. Investigators conducting field studies in this area should be alert to this possibility. These hypothesized relationships in the genus *Delophon* are depicted in Fig. 11.

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